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On the structure and nucleation mechanism in nucleated isotactic polypropylene crystallized under high pressure

Przemyslaw Sowinski¹, Ewa Piorkowska^{1*}, Severine A.E. Boyer², Jean-Marc Haudin²

¹Centre of Molecular and Macromolecular Studies, Polish Academy of Sciences, Sienkiewicza 112, 90 363 Lodz, Poland

²Centre for Material Forming, MINES ParisTech, PSL – Research University, UMR CNRS 7635, 1 Rue Claude Daunesse, 06904 Sophia Antipolis, France

ABSTRACT

Nucleating agents used for the monoclinic α -form of isotactic polypropylene (PP), commonly occurring under atmospheric pressure, are able to nucleate its crystallization in the orthorhombic γ -form under high pressure. Nucleation of γ -lamellae is possible through epitaxy involving (001) γ crystallographic plane on substrates nucleating the α -form through epitaxy engaging (010) α plane because of equivalency of both planes. Another possibility is nucleation of α -lamellae through epitaxy involving either (010) α or (110) α plane, and formation of the γ -phase through γ/α epitaxy. The study focuses on the structure and mechanism of nucleation of high pressure crystallization of PP with selected nucleating agents: poly(tetrafluoroethylene) particles, commercial Hyperform HPN-20E and ADEKA Stab NA11UH. The nucleated PP was isothermally crystallized in the γ -form under pressure of 200 and 300 MPa and studied ex-situ by WAXD, PLM and SEM. Analysis of lamellar structure provided insight into the nucleation mechanism of high pressure crystallization of PP. In all the materials the α -lamellae were nucleated first and served as seeds for the γ -form.

Keywords: nucleation; gamma-form; isotactic polypropylene

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